

An Intelligent Hierarchical Approach to Actuator Fault Diagnosis and Accommodation, Phase I

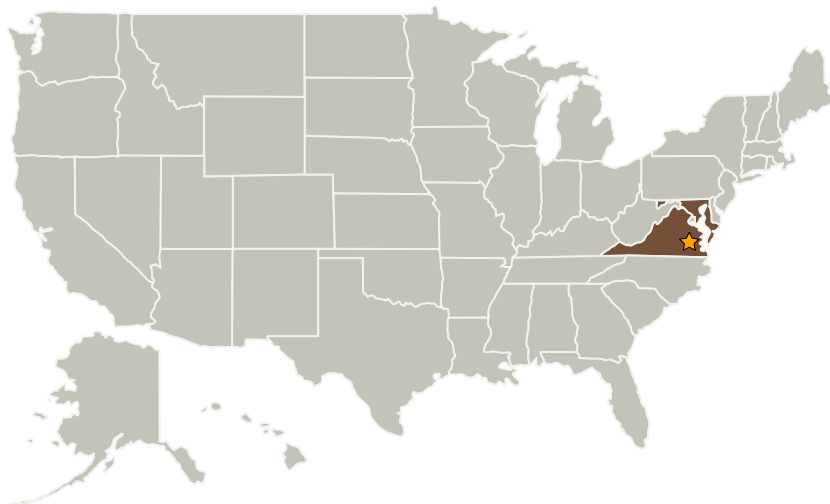
Completed Technology Project (2005 - 2005)



Project Introduction

This proposal presents a novel intelligent hierarchical approach to detection, isolation, and accommodation of primary aerodynamic actuator failures. The proposed architecture has three main components. First, a nonlinear fault diagnosis scheme is used to detect any fault occurrence and to determine the particular fault type. The proposed method can directly deal with nonlinear systems and nonlinear faults, unstructured modeling uncertainty, and new and unanticipated faults. Second, a controller module consists of a primary nominal controller and a secondary adaptive fault tolerant controller. While the nominal controller can be any existing conventional flight control system, the secondary neural network (NN) based adaptive controller is designed to accommodate primary control surface failures by utilizing control redundancy. A pseudo-control hedging method is used to prevent the NN from adapting to various actuation anomalies. Third, a reconfiguration supervisor makes decision regarding controller reconfiguration and control reallocation by using on-line diagnostic information. The proposed architecture is attractive in particular as a retrofit to previously certified flight control systems for improved flight safety. Our primary Phase 1 research objective is feasibility demonstration through extensive simulation studies. In Phase 2, we will refine the algorithms and develop the real-time control software.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Intelligent Automation, Inc.	Supporting Organization	Industry	Rockville, Maryland

Primary U.S. Work Locations

Maryland	Virginia
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Xiaodong N Zhang

Technology Areas

Primary:

- TX10 Autonomous Systems
 - └ TX10.2 Reasoning and Acting
 - └ TX10.2.6 Fault Response